

# A Fast, Affordable, Science and Technology SATellite (FASTSAT) and the Small Satellite Market Development Environment

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The National Aeronautics and Space Administration at Marshall Space Flight Center and the National Space Science and Technology Center in Huntsville Alabama USA, are jointly developing a new class of science and technology mission small satellites. The Fast, Affordable, Science and Technology SATellite (FASTSAT) was designed and developed using a new collaborative and best practices approach. The FASTSAT development, along with the new class of low cost vehicles currently being developed, would allow performance of ~ 30 kg payload mass missions for a cost of less than 10 million US dollars.

**Key Words:** Microsatellite, COTS, Legacy Designs, Reliable Simplicity, Upgradeable

## 1. Introduction

The development of small satellite platforms and the use of small satellite missions are far from a new concept. In fact, by today's definition of small satellites, the first successful satellite mission in 1957, Sputnik-1 with a mass of 83.6 kg, accomplished by the former Soviet Union was also the first small satellite that was uniquely designed for a very specific set of mission requirements and "market niche" which were very minimal objectives by today's mission fulfillment standards. However, the engineering, scientific, political, societal and economic impacts catalyzed by this small satellite mission are clearly one of the greatest contributions to the history of human innovation. Today, the National Aeronautics and Space Administration at Marshall Space Flight Center and the National Space Science and Technology Center in Huntsville Alabama USA, are jointly developing a new class of science and technology mission small satellites. The Fast, Affordable, Science and Technology SATellite (FASTSAT) was designed and developed using a new collaborative and best practices approach.

## 2. Background and Project Description

The key to achieving low cost is frequent launches utilizing standardized launch vehicles and spacecraft busses. A comprehensive and cost effective capability that brings together all the traditional launch and spacecraft elements needed to provide low-cost government science and technology mission access to space is needed to position space experiment projects successfully for the future.

For example, today in many instances, NASA as well as other government sponsored space experiment research activities alone are unable to support large project investments that require large long term expenditures for the traditional large complex launch and spacecraft missions to benefit fully just to a single organization for a true return on investment. FASTSAT is an integrated spacecraft that will satisfy both exploratory science missions that require longer observing times than available from sounding rockets and nanosat class spacecraft, as well as support technology readiness demonstration mission that require varying levels risk management. Fast, Affordable, Science & Technology SATellite (FASTSAT) FastSAT is a low-cost microsatellite bus approach

- Supports NASA MSFC program vision to develop responsive, low-cost civil space science capability enabled by satellite miniaturization and low-cost launchers
- \$3M - \$4M cost of bus (opposed to \$20M+)
- Current mass is 100 kg (without science instruments)
- Only requires structural interface with launcher
- Current model intended for 6 months on-orbit ops
- Smaller buses to be developed in future for even smaller payloads (nanosats and picosats)

The FASTSAT program was conducted to qualify the NASA collaborative team process for developing low-cost, responsive small satellite spacecraft while providing space qualified FASTSAT hardware (though no production is planned) in a timely manner to support a potential launch of the NASA Microsatellite (FASTSAT I) for a 12 month fast track schedule with a 140kg payload, 100kg without payload on a ~ 1m X 1m hex column bus structure. FASTSAT is brutally simple, safe, low risk, low impact to launcher with no propellants/fluids, no deployables, no moving mechanisms no high temps, pressures, or voltages/ currents, no star tracker, no CMGs, no RCS jets. In addition, a 2.5 safety factor on structure was designed to eliminate load test by providing large margins. Body Mounted, triple junction GaAs solar panels, NiCad batteries provide power.

#### 4. Lessons Learned

The Fast, Affordable, Science and Technology SATellite (FASTSAT) was designed and developed using a new collaborative approach driven by using:

- Soft requirements for pre- PDR and hard requirements for post-CDR
- Maximization of COTS systems and legacy designs
- Simplicity in basic design
- Shortest schedules
- Non dedicated work force
- Risk/ Benefit metrics
- Rapid launch response planning
- Motivated partners